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ABSTRACT

The Technology-Rich Authentic Learning Environments (TRALE) project aims to improve young children's literacy skills through the creation of a community of technology enriched classroom environments. TRALE has been implemented in kindergarten through grade 3 classrooms in one urban elementary school in the District of Columbia, a school located in an area of high poverty, high crime, and much drug use. The school has been identified as one of the city's 20 lowest performing schools. The implementation of the TRALE program, with its emphasis on multimedia computing and an authentic learning environment characterized by a cognitive apprenticeship approach, was studied by determining student achievement, teacher perceptions, and the degree of program implementation by each teacher. TRALE increased student achievement even during its first year of operation. The eight TRALE teachers understood and appreciated the educational potentials of the technology. High-implementing teachers addressed the role of the community and their classroom roles while low-implementing teachers did not. Evaluation results clearly show that TRALE's effectiveness was related to the degree of implementation by the teacher. There was great growth in students' academic progress in highly implemented teachers' classes compared to low-implementing or non-project teachers' classes. These formative results show the promise of TRALE for educational improvement in urban schools. (Contains 14 references.) (SLD)

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ED 429 123

A Formative Evaluation of the TRALE (Technology-Rich Authentic Learning Environments) Project

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The purpose of this paper is to present a formative evaluation of the TRALE (Technology-Rich Authentic Learning Environments) project from its pilot implementation in the 1995-96 school year through the 1997-98 school year. TRALE, designed for early childhood classrooms, aims to improve young children's literacy skills through the creation of a community of technology-enriched classroom environments. TRALE has been implemented in K-3 classrooms in one urban elementary school in the District of Columbia.

In this paper, we describe TRALE and provide an evaluation of its effectiveness. The major sections of this paper are the following: (1) TRALE and its context, (2) a detailed description of TRALE and its implementation, and (3) TRALE's effectiveness as seen in student performance, teacher perceptions, and as a function of implementation by the teachers.

TRALE and its Context

In this section we describe the school, the children, and the political climate that have affected the evolution and degree of implementation of TRALE. Subsequently we provide a brief history of TRALE's development. The evolution of TRALE is described by Walker and Yekovich (1998) in more detail.

The School, The Children, and The Climate

Target Elementary School is a public school in the District of Columbia Public School (DCPS) system. Target Elementary is located in an area of high poverty, high crime, and rampant drug use. The school is located in an environment that is characterized by a lack of a thriving and varied community. The school's environment is basically literacy barren.

The student population is 100% African American. Over 97% of the children qualify for free breakfast and/or lunch. About 90% of the students live in the public housing complexes, which immediately surround the school. The large majority of children come from single-parent

families or reside with relatives. The instability of the home environment, coupled with high poverty, creates a great deal of variability in the importance placed on literacy within the home. These conditions also produce variability in the children's general readiness for school, especially with respect to academic, social, and motivational readiness. Not surprisingly, the children who attend Target tend to have behavioral difficulties and low levels of motivation to succeed academically. The high incidence of poverty produces substantial transience and of course is also related to the high truancy and dropout rates at the school. In short, the target population for which TRALE is intended consists of young, poor, urban minority children who are at high risk of educational failure.

The context in which TRALE has existed for the last 3 years cannot be described as one that wholeheartedly promotes and supports new educational initiatives. Several obstacles hindered TRALE's evolution into the successful project it is today. One of many sources of frustrations affecting TRALE's implementation originated from DCPS itself. The actions of the new chief executive officer (CEO) who was appointed to replace the superintendent in DCPS have stressed the system to a great extent and have heightened the levels of fear and distrust among teachers and administrators within the schools.

Target Elementary has been identified as one of the 20 lowest performing schools within DCPS. The published results of the Fall, 1997 standardized testing showed Target as **the lowest performing school** in reading and mathematics. As a result, the school was mandated to adopt a whole school reform model called the Adaptive Learning Environments Model (ALEM) created at Temple University. The introduction of ALEM created additional tensions at the school and in fact has made the implementation of TRALE more difficult.

Traditionally, the early childhood grades were operating without a standard reading and math curriculum and little attention was paid to the alignment of curricular components with expected performance and with formal assessment. The 1996-97 school year was the first full year in which the teachers were expected to use the Houghton-Mifflin reading and math series that DCPS had adopted and purchased. The long standing lack of alignment between the curriculum and assessment practices, coupled with the abrupt mandate to completely embrace and implement a poorly understood, but new curriculum resulted in even more obstacles in the implementation of the TRALE project.

A Brief History of TRALE

The TRALE team's involvement with Target started in the fall of 1993 when the Principal Investigators (PIs) of the project began volunteering as tutors. From very early on, the PIs were struck by a paradox. Observations of the young children in informal, natural settings clearly showed them to be competent, motivated problem solvers and capable "information processors" (cf. Gagne, Yekovich, & Yekovich, 1993). Yet, equally clear was the observation that formal assessment of these children, especially when based on standardized tests, was significantly below par. Why do young children who appear to be cognitively competent in many informal settings fail to master formal cognitive skills and fail to display the competence they do have on formal, standardized tests? This paradox became the primary motivation for designing TRALE.

TRALE's two foundational pillars are technology and authentic learning environments. The technology component of the project was funded by Apple Computer, Inc. in the 1994-95 school year. As a result, multimedia computing became a part of four early childhood classrooms at Target during the 1995-96 school year. Over the years a substantial amount of new technology has entered the building, and at present each classroom (K-6) has two to six networked,

multimedia computers, and a printer. Some supplemental technological equipment, such as scanners and digital cameras are shared among classes.

The instructional component in the form of authentic learning environments was developed with the support of the Mid-Atlantic Region's Laboratory for Student Success (LSS) located at Temple University at the beginning of 1996. During the spring of 1996, TRALE underwent pilot implementation in the four Apple classrooms. At the beginning of the 1996-97 school year, TRALE was implemented in five early childhood classes at Target and this implementation continued throughout the school year. The number of implementing classrooms grew to 8 in the 1997-98 school year. The next section describes TRALE's implementation in detail.

A Description of TRALE and Its Implementation

What is TRALE? In essence TRALE is a principled framework for designing meaningful instruction for children. Meaningful instruction is created through the use of authentic, problem-based learning activities, and when appropriate, technology is utilized as a tool in the activities. So, for example, children may learn to alphabetize by creating an inventory list for their classroom store, and once the list is made, it may become a computerized spreadsheet that is used for real inventory and accounting purposes.

At Target Elementary, TRALE is operationalized as a community comprised of businesses, service organizations, and special interest groups. Each classroom assumes a unique role (e.g., a store, newspaper, theater group, museum, art gallery, video store, post office, and poetry club) and together the classrooms engage in the exchange of goods and services. For instance, one or more reporters from the newspaper may review a performance by the theater group and write about it. The TRALE concept is closely tied to the successful interactions within the classroom and among the members of the community.

Theoretical Underpinnings

Our approach to the teaching of literacy (i.e., reading and writing) has its roots in cognitive science (e.g., Anderson, 1987, 1993). For us, reading and writing, like all cognitive activities are essentially problem-solving in nature and are best acquired in problem-based learning environments (see Anderson, 1995, p. 221). Like other complex cognitive skills, people **develop expertise** in reading and writing, and the course of that development parallels in many important ways the development of other types of cognitive competence (Scardamalia & Bereiter, 1991). Similarly, just as experts in general rely on both automated and conscious skill components, expert readers and writers automate some parts of the skills and retain other parts as conscious strategies (Just & Carpenter, 1987).

At the same time, we believe that sociocognitive and sociocultural factors have a large impact on the organization and content of one's declarative and procedural knowledge (See Langer, 1987; Vygotsky, 1987). Since thought and action are functions of one's knowledge base, the social contexts that house the experiences of individuals directly shape the nature of a person's thoughts and actions. In this sense, one's cognitions are situated within particular social contexts.

One instructional application that relies heavily on many of the concepts associated with the development of expertise in situated contexts is that of the *cognitive apprenticeship* (see Brown, Collins, & Duguid, 1989). In general, cognitive apprenticeships are authentic instructional environments in which one or more students (apprentices) study a domain or discipline or profession under the mentorship of someone more skilled, with the stated intention of developing expertise in that particular area. We believe that the concept of a cognitive apprenticeship can be successfully applied to early literacy instruction.

Cognitive apprenticeships have at least three features, which make them potentially useful as instructional models. First, the Expert – Apprentice relation allows for intensive one-on-one tutoring. As part of this tutoring relation, the Expert "scaffolds" for the Apprentice thereby (1) exposing the internal representation of a problem, (2) guiding the Apprentice through the problem space of the problem, and (3) acting as a model problem solver (thereby demonstrating the goal-subgoal structure of the problem and the strategy for solving it). In subsequent interactions, the Expert points out similarities and differences between and among problems. All the while the Expert monitors and assesses the progress of the Apprentice. This process is akin to keeping the Apprentice in her zone of proximal development (Vygotsky, 1987). Together, these tutoring activities help the Apprentice build an organized, elaborated, and systematic understanding of the domain, an understanding that is personally meaningful.

The second important feature of cognitive apprenticeships is that they are situated in problem-based learning activities, which are authentic or real rather than decontextualized or artificial problems often found in classrooms. The supposition is that authentically acquired and used knowledge is more likely to transfer to other real-world situations. In problem-based learning environments, students acquire cognitive competence by working on real problems that challenge their current level of thinking, rather than working solely on isolated parts of a problem or on problems they'll never encounter outside of school. As the students' processing capabilities become more sophisticated, the level of problem difficulty and the students' level of responsibility for solving the problem increase accordingly. One integral result of working on real problems is that students have many natural opportunities to practice small, specialized, sets of cognitive activities in context. Eventually, automated basic skills develop as subroutines within the goal structure of larger problem-solving procedures.

The third relevant feature of cognitive apprenticeships concerns the inherent social character of the learning environment (e.g., Vygotsky, 1987). By design the environment creates a high degree of interaction rather than having an individual work in isolation. This interaction may take the form of collaborative problem solving, direct instruction, informal assessment, and coaching. Through these interactions, the roles of the members are defined. One prerequisite for successful maintenance of the apprentice relationship is legitimate contribution by each apprentice according to his/her role.

Because of the realities of classrooms, we are attempting to extend the notion of apprenticeships to include several apprentices (and/or several "experts") rather than only one. In this sense our view of apprenticeship is more in keeping with the model found in advanced graduate training (e.g., medical school, doctoral programs), rather than the traditional model of a single master and one apprentice (see for example, Salomon, 1993). It is also consistent with concepts such as peer tutoring where a more skilled individual (albeit a peer) teaches a less skilled one.

These three features of the apprenticeship model form three of the five critical characteristics of TRALE classrooms. We refer to these three dimensions as *Goal Directedness, Authenticity (i.e., Contextualized),* and *Community (or Shared Responsibility).* Because of our special interests in young school-age children and in technology, we have added two additional critical dimensions to TRALE. We have adopted a definition of literacy, which includes *Multiple Modes of Expression and Representation.* The fifth critical dimension is the *Use of Technology.*

TRALE has the following critical dimensions:

1. **Goal Directedness**

   Goal directedness refers to the idea that human thoughts and actions are purposive. One function a mentor serves is to help the novice see the goal-subgoal relations in real-world problems.

2. Authenticity

Authenticity refers to the idea that students have some meaningful prior knowledge that can be brought to bear to aid in understanding new concepts and solving new problems. Simulating a store in the classroom is meaningful and authentic because of the children's knowledge and experiences with neighborhood stores. Thus, alphabetizing a list of items for a store's inventory becomes a "real" or "authentic" task.

3. Shared Responsibility

Shared responsibility refers to the social nature of the learning process. In part, shared responsibility promotes the motivation for learning. When a child understands that he is a member of a community and the successful operation of this community partially depends on his performance, s/he is more willing to perform the task and motivate the others to do the same. These children become more independent because they have an ownership of the learning process.

4. Multiple Modes of Expression and Representation

This critical dimension applies to children's literacy and math development. Young children are constrained in the ways in which they can understand and communicate meaning-making events or in their understanding of concepts. For instance, kindergartners cannot read and/or write yet. Consequently, one must allow that literate expression take other forms (e.g., art or acting) or that understanding or acquisition of a particular concept be demonstrated in various modes (e.g., addition on a sheet of paper or using manipulatives). Similarly, instruction should provide multisensory opportunities for acquiring literacy and math skills so that children will develop enriched representations of their world.

5. Use of technology

The use of technology serves 4 purposes. First, technology use is integrated to serve as an authentic tool in the classroom learning environments (e.g., spreadsheets for keeping inventory, invitation letters to the play, or editing newspaper articles). Second, technology acts as an ancillary tool for aiding in the decontextualized practice of skills (e.g., during choice time, children can select to play the game *Number Munchers*, which is a math game that teaches number facts). Third, technology is a motivational tool that keeps children on task for extended periods of time. Last but not least, computer skills are a competency that is required for success in today's world.

TRALE's Implementation

Here we detail how TRALE was conceptualized and implemented from its pilot implementation from its pilot until the 1997-98 school year. As mentioned before, TRALE has

two delivery components, a technology component and a component dealing with authentic learning activities. In the following paragraphs, we describe each component in detail.

TRALE's Technology Infrastructure. Each classroom is now equipped with 2-6 Apple Power Macintosh 5200/75 LC, 5400/200 LC, and 5500/225 LC computers. Besides these computers, each TRALE classroom has a printer, a digital camera, and multiple sets of headphones. Additionally, three color scanners are shared among the eight classrooms. The computers have built-in CD ROM drives, as well as 3.5" floppy disk drives, and all have upgraded RAM (24 MB) and Ethernet capability. The machines came with 15" color monitors, 500 MB hard drives, and 75 MZ processors. The machines use the OS 7.5.1, OS 8.0, or OS 8.5 operating systems.

The computers and printers are networked both within and across classrooms and use the EtherTalk protocol for communication (i.e., Apple's Ethernet protocol software). Within each classroom, Farallon EtherWave technology is used to create a daisy chain network, and the classrooms are connected together via Farallon Starlet Hubs (2 Starlet 8's and 1 Starlet 16). The virtue of this network design is that multiple computers in a classroom can access network services (e.g., Internet and the World Wide Web) simultaneously even though the classroom has only one direct network connection.

A variety of software, which was either installed or accessible via CD-ROM, focus on specific skills. Some of the software includes games and activities related to math, language arts, and other areas, such as integrated word processing, spreadsheet and data base, word processing and letter-sound matching activities on various levels, desktop publishing for children, multimedia authoring, keyboarding skills, interactive multimedia books and games, interactive story writing and reading, work recognition games, reading comprehension, phonics, and spelling, games of math facts of varying difficulty, fundamental number concepts, addition, subtraction, multiplication, and division, drawing and simple animation, digital image

downloading and editing, scanning, painting, coloring, costumes, block art, stickers, and games like checkers.

Technology use was integrated into the classroom activities in two distinct ways. First, teachers set up the computers as a "center" and consequently used them for individual and small group activities such as reading, writing , math, and art. The other distinct use of technology revolved around each classroom's unique role within the community. Because each classroom simulated some service or organization within the community, technology was employed as part of the ongoing functioning of the agency. For instance, the employees of the general store used a spreadsheet software for inventory purposes. Additional "authentic" uses of technology are mentioned in the next section.

Creating Authentic Literacy Environments: The Community. Our idea of meaningfulness and authenticity entails the creation of classroom environments in which the opportunities for acquiring literacy and math skills simulate those situations that make sense in the everyday worlds of the children. Thus, in TRALE, each classroom in the project simulated a unique organization that was tied meaningfully in some way to the children's lives. All the TRALE classrooms with their classroom roles made up one community.

Within each classroom, part of the language arts component of the curriculum was designed around sets of problem-based activities that created its role within the community. To illustrate, the theater was organized as a performing arts company, which performed plays and poetry recitals publicly in the community. To accomplish their goal, the members of the theater had to engage in a number of problem-based activities that fostered literacy development. For instance, some of the activities included creating scripts, designing sets, publishing programs and announcements, learning lines, playing a role, and communicating a story to a watching audience. Each of the activities in turn could be tied to specific language arts standards specified

by DCPS, and a number of the activities naturally relied on technology use (e.g., preparation of programs, creation of art for the sets).

Each classroom was conceptualized in the same manner as the theater. Each organization had a particular goal or function, each had a number of problem-based activities that had been designed to foster literacy development (using the DCPS language arts standards as the objectives), and each class used technology for authentic purposes in the accomplishment of its community role (e.g., spreadsheets for inventory control, graphics for the creation of African art in the museum). As children progressed from K through 3rd grade, the expression of literacy expected became more "standardized" in the sense that they gradually required more traditional forms of reading and writing from the children.

Because some of the community's organizations were "businesses," there was a need for an economy. Essentially, each classroom established its own system for paying students "money." Typically, earnings were tied to jobs in the classroom (both general and organization-specific), and other factors, such as attendance and punctuality. Generally, students were paid every two weeks and had at least one opportunity per week to spend their earning. Project teachers agreed on the scale for earnings so that all contributing members of the community received approximately equal salaries.

The community functioned at two levels, within the classroom (as is evident from the above description) and across classrooms. Across classrooms, the community functioned through the exchange of goods and services. For instance, the actors, artists, and reporters checked out videos and shopped at the store. Similarly, store clerks received the newspaper and attended the exhibits of the museum. The interactions between and among classrooms also required the application of literacy and math skills. News reporters wrote reviews of the exhibits and

productions, and published them in the newspaper. Similarly, the mailmen wrote about their shopping experiences.

The concept of service agencies within a community attempted to capitalize on a primary social need of people; namely, that people want and need to be legitimate, contributing members of a group (e.g., family, church, gang). The incentive to belong was utilized as the motivation for wanting to learn literacy and math skills, because within the environments and the community, the major way to be a legitimate group member was through literacy- and math-based contributions.

Conceptually, the cognitive apprenticeship features discussed earlier formed the core of our instructional model. We stressed the use of problem-based activities in which (a) a variety of methods of interaction occurred (both teacher-student and student-student), (b) scaffolding was used to expose the structure and the strategies used to solve problems, (c) the learning environment evolved to accommodate the children's increasingly sophisticated processing capabilities, and (d) the nature and purpose of the group endeavor (i.e., the goal for which the group strives) was presumably continually made obvious to the children so that they understood why they were doing the things they did.

Students worked individually, in pairs, and in different size groups. Sometimes they were required to be self-regulated, as when kindergartners shopped at the store and when news reporters roamed the school building doing research for their stories. To a large degree various forms of collaborative learning were the norm. Students helped one another in natural ways to become more competent and productive members of the classroom's role in the community. Teachers had opportunity for direct instruction in the form of mini-lessons, but the nature of the activities made the students more active and inquisitive as they worked toward the classroom goal.

One of the most important questions in a formative evaluation process is whether the project is effective. In other words, is TRALE achieving its primary goal of improving student achievement? We turn to this issue in the next section of the paper.

A Formative Evaluation of TRALE

Throughout TRALE's implementation, we have systematically gathered documentation on the students, the teachers, the classrooms, and the project staff from CUA. Table 1. below describes all the data that have amassed for our evaluation purposes.

Table 1. Sources of Data for Evaluation Purposes.

Target Group	Documentation
Students	1. *CTBS* scores 2. *SAT-9* scores 3. Periodic portfolio products, including writing samples 4. Videotapes of reading samples
Teachers	1. Weekly journal entries on project activities, successes, problems, needs, and plans 2. Minutes from the periodic meetings with CUA staff 3. End-of-year interviews with the individual teachers
Classrooms	1. Periodic videotapes of classrooms engaging in community-related activities 2. Artifacts produced as part of the class's role in the community 3. Calendars of community events and activities
CUA Project Staff	1. Minutes/notes from periodic staff meetings 2. Weekly journal entries from the TRALE project coordinator 3. End-of-year interview with the TRALE project coordinator

Much of the documentation has been analyzed. In this section, we are reporting on those analyses to date, focusing on three areas: (1) student achievement as measured by standardized test performance, (2) teachers' perceptions about TRALE, and (3) teachers' degree of implementation of TRALE.

Student Achievement

As Table 1 displays above, besides the standardized tests used by DCPS (the Comprehensive Test of Basic Skills [*CTBS*], which was replaced by the *Stanford Achievement*

Test, Ninth Edition [SAT-9] in the 1996-97 school year), we have collected a variety of documentation on the students in the TRALE classrooms, such as reading samples and portfolio products including writing samples. Since, however, the ultimate test of the effectiveness of any instructional intervention is whether it improves student performance, we concentrate here on student achievement as measured by standardized tests.

The *SAT-9* test is administered to children in grades 1 through 6. Most of the children at Target Elementary are tested in each October and May. For our analyses, we decided to capitalize on the test – retest format that the double testing produced. Since we had repeated measurements on most children, we were able to compute **growth** or **change** "within each student." This eliminated the need to worry about whether TRALE and Non-project classrooms had students of equal ability. For the pilot study in the 1995-96 school year, we report Grade Equivalent Scores (GES) because DCPS published student achievement in this format. For the 1996-97 and 1997-98 school years we report NCE scores because DCPS used NCE scores in its analyses and reports back to the schools once it replaced *CTBS* with *SAT-9*. The percentages also allowed for comparisons to the national norms (i.e., percentile-like rankings). Using NCE scores, we were able to compare change in NCE from Fall to Spring in order to look at the degree to which a particular class's relative standing changes (i.e., does the class remain at its standing, or does it move up or down.)

Grade Equivalent Scores are reported in terms of a student's grade level year and month of achievement. Thus, a score of 1.1 means that a student is working at the level of first grade in the first month of school. If a student's score changes from 1.1 to 1.7 in a 6-month period, one can infer that the student is progressing at a normal rate. **NCEs** are normalized standard scores with a mean of 50 and a standard deviation of 21.06. The standard deviation of 21.06 was chosen so that NCEs of 1 and 99 are equivalent to percentiles of 1 and 99. There are approximately 11

NCEs to each stanine. NCE scores are like percentile ranks, which are computed from a frequency distribution that is known to be unimodal and symmetric about its midpoint. Thus a value like 21.2 translates roughly to the 21%ile in a normal distribution of scores. National NCE scores are taken from the normal distribution of the national sample of students who have taken the test.

When TRALE was designed and first implemented in Target Elementary in the 1995-96 school year, TRALE's main goal set by its PIs was to increase student achievement significantly in its **third** year of implementation after its pilot. There are 3 reasons why TRALE was not expected to produce marked changes in student performance during the first two years of implementation following the pilot: (1) According to research, new programs on average are expected to increase students' test scores significantly only after 2 years of full implementation, (2) TRALE's implementation was always delayed due to unfavorable conditions at the beginning of each school year, and (3) the selected group of teachers' participation in TRALE was always voluntary.

No matter how ingenious an educational invention, program, or project may be, it cannot produce significant changes in academic progress unless it is fully and consistently implemented to a high degree. It is our belief that in order to make a dramatic difference in students' achievement, TRALE has to be highly implemented. Thus, we categorized the teachers according to their degrees of implementation. During the first 3 years of the project including the pilot year, teachers' degree of program implementation was assessed according to a complex system including (1) the project facilitator's observations and her anecdotal evaluation of classroom roles, (2) teachers' meeting attendance, (3) number of teacher journal entries submitted, (4) quality of teacher journal entries, and (5) the number of planned community activities and events accomplished. At the end of the 1997-98 school year, the project team

devised a 123-item instrument called the Degrees of Implementation for the TRALE project (TRALE DOI) in order to formally assess program implementation. The TRALE DOI data using this new instrument will be available for TRALE's formative evaluation in the 1998-99 school year. We will return to the teachers' degree of program implementation in the last part of this paper.

As described above, we divided all the teachers in K-3 classes from the 1996-97 and 1997-98 school years into 3 groups: (1) high implementing TRALE teachers, (2) low implementing TRALE teachers, and (3) non-project teachers. We assumed that students' achievement would be significantly higher in the high implementing teachers' classes compared to low implementing and non-project teachers' classes.

Our analyses include a comparison of a high implementing teacher vs. a non-project teacher in the pilot study in the 1995-96 school year, and the comparison of high implementing teachers vs. low implementing and non-project teachers in the 1996-97 and 1997-98 school years. In these 2 school years there were 4 high implementing, 4 low implementing, and 7 non-project teachers. In each year TRALE was implemented, the size of the school enabled us to have at least one TRALE and one non-TRALE classrooms on each grade level. However, we were able to collect complete and reliable data only in 15 out of the 18 classrooms in our analyses.

Since in 1995-96, DCPS used GES in their reports on students' academic achievement, we based our analyses on GES in that school year. Scores were reported not only on total reading but also on subtests, thus, we were able to compare students' growth in each area tested. Since the measure of growth is "within student," it eliminates spurious differences attributable to nuisance variables (e.g., overall differences in ability across classes) and provides a more stable indicator of change within an individual over time.

Table 2. displays children's GES in each subtest in the TRALE and non-project class.

Table 2. Comparison Between a TRALE Project Classroom and a Non-project Classroom in Terms of Growth* from 1st to 2nd Grade on the CTBS test.

CTBS Subtests	General Store (n=15)			Non-project (n=15)		
	1st	2nd	Growth	1st	2nd	Growth
Reading						
Vocabulary	1.25	1.98	**.74**	1.64	1.71	**.07**
Comprehension	1.37	2.37	**1.01**	1.46	1.82	**.36**
Total	1.33	2.16	**.83**	1.54	1.78	**.24**
Language						
Expression	1.16	1.86	**.7**	1.59	1.66	**.07**
Mathematics						
Computation	1.1	3.49	**2.39**	.75	2.24	**1.49**
Application	1.09	2.54	**1.45**	1.43	2.90	**1.47**
Total	1.06	2.84	**1.78**	1.12	2.42	**1.30**

*Growth is defined in number of years progressed (i.e., Grade Equivalent Score).

Table 2 displays the growth results for our project classroom in the 2nd grade (general store) and a non-project 2nd grade classroom. The table presents the average growth, in number of years progressed, of the children in the two classrooms. A number of important results are immediately visible. First, the columns labeled "Growth" show a substantial positive effect for our project classroom. In reading, the gains in the TRALE classroom were enormous compared to the non-project classroom. In the vocabulary subtest and language expression the gains were tenfold, in reading comprehension and total reading threefold; in math the gains were variable but generally large (e.g., math computation shows .9 years of additional benefit for the project classroom). Though not of primary interest of the project, the math results are also important because they provide validation to the idea that naturally emphasized, authentic activities lead to increased learning. Since a substantial amount of store activity involves math (e.g., pricing,

making change, calculating credits),. it would make sense that math skills improve as a by-product.

Also note that the TRALE classroom's 1st grade (pretest) scores were **lower** than their non-project counterparts on the *CTBS*, yet consistently **higher** on their 2nd grade posttest. Thus, the TRALE implementation in the project classroom not only produced substantial growth, it also appeared to be particularly effective for the students with the lower 1st grade test scores.

All the differences between the TRALE and non-project classroom with the exception of the Math Application subtest were significant: (1) Vocabulary [p=.001], (2) Reading Comprehension [p=.01], (3) Reading Total [p=.003], (4) Language Expression [p=.005], (5) Math Computation [p=.055], and Math Total [p=.034].

As mentioned before, we collapsed all the teachers across the 1996-97 and 1997-98 school years and according to their degrees of program implementation. Three of the 8 teachers, who taught kindergarten, are not involved in this analysis for kindergartners are not tested by *SAT-9*. In the 1996-97 and 1997-98 school years the subtests reported by DCPS were different from the ones reported in the 1995-96 school year. Thus we decided to use the total reading score in our analyses. Table 3 displays student achievement scores in (1) high implementing, (2) low implementing, and (3) non-project teachers' classes.

Because we had access to the total reading scores in NCE format, we used them in our growth analysis in the 3 groups of teachers. Table 3. indicates students' total reading scores in an NCE format as well as the average in each group of high implementing, low implementing, and non-project teachers.

Table 3. Growth in Students' Total Reading Scores on the *SAT-9* Test in 6 months in Each Teacher's Class and Average of Growth in Total Reading across Classes in the 3 Groups of Varying Degrees of Implementation.

Group of Classes According to Degrees of Implementation	*School Year*	*Total Reading Fall Semester* and **Average in Group**	*Total Reading Spring Semester* and **Average in Group**	*Growth in NCE points*	*Average Amount of Growth in NCE points across Classes in Each Group*
High Implementing Teachers					
General Store	1996-97	22.8	24.6	1.8	
General Store	1997-98	21.2	37.5	16.3	**10.9**
Newspaper	1996-97	19.9	31.0	11.1	
Post Office	1997-98	21.2	35.6	14.4	
		21.3	**32.2**		
Low Implementing Teachers					
Newspaper	1997-98	26.8	30.0	3.2	
Video Store	1996-97	37.2	24.2	**-12.9**	**1.1**
Video Store	1997-98	30.4	37.6	7.2	
Poetry Club	1997-98	20.8	27.8	7.0	
		28.8	**29.9**		
Non-Project Teachers					
2nd grade (A)	1996-97	21.1	20.4	**-.7**	
2nd grade (A)	1997-98	21.2	33.6	12.4	
2nd grade (B)	1996-97	22.8	22.1	**-.7**	
2nd grade (B)	1997-98	29.1	37.4	8.3	**2.7**
1st grade (A)	1996-97	32.5	25.8	**-7.2**	
1st grade (A)	1997-98	31.0	42.6	11.6	
1st grade (B)	1996-97	39.5	34.5	**-5.0**	
		28.2	**30.9**		

Our data analyses revealed several noteworthy results. First, the degree of program implementation was clearly related to growth in the students' total reading scores. Average growth in students' total reading scores in the high implementing teachers' classes was tenfold compared to low implementing teachers' classes and sevenfold compared to non-project teachers' classes.

Second, students in the high implementing teachers' classes seemed to begin the school year at a lower reading level (21st %ile) when compared to children in the low implementing

(29th %ile)and non-project (28th %ile) classes. However, by the end of the year, children with lower NCE reading scores at the beginning of the year slightly outperformed those children who started the year in a better position.

Summary. Even though TRALE was not expected to increase achievement scores on the standardized tests during the first 3 years of its existence, it was a successful project in doing so even in the first year of its pilot implementation and every school year thereafter. Students' standardized test scores have indicated that TRALE significantly increases student achievement if it is highly implemented.

Teacher Perceptions of TRALE

This section of the paper is devoted to an evaluation of TRALE from the teachers' perspective. The source of the information for the analysis is the end-of-year interviews with each teacher. The interview questions were grouped around three major topics: the use of technology, the role of the community as an authentic learning environment, and the teachers' conceptualization of TRALE.

Findings. The Role of Computers

All TRALE teachers understood and appreciated the educational potentials of technology. They expressed that computers helped their children acquire their literacy skills. They all described computer activities for the children; for example, kindergarten children could type up their names as well as invitations to the Museum or the Theater, the 3rd graders could write and edit stories to be published in the newspaper, and the letters to be delivered by the post office were written on the computer also. The teachers thought that having computers in the classrooms was very beneficial for the children, but technology was not sufficient by itself to provide quality instruction.

It was obvious from the interviews that in the high implementing teachers' classes the children spent considerable time at the computers whereas in the low implementing classes each child's computer time was quite limited. The nature of the computer activities in the high and low implementing classes also varied. In the high implementing classes the activities on the computer were more diverse, creative, and related to specific curriculum standards. However, in the low implementing classes the activities seemed to have been assigned more haphazardly and based on their appeal to the teacher.

High implementing teachers developed a system to ensure that each child had an equal chance of using the computers. Because low implementing teachers did not use a self-scheduling procedure or a rotation system, they could not keep track of who worked on the computer and on which days. These teachers tended to reassign those children who had more proficient computer skills and thus needed less teacher assistance in completion of the task. This procedure resulted in a situation where not every child had equal access to technology.

Another big challenge for low implementing teachers was the issue of control. For some it was hard to let go of control and empower their children by letting them make decisions on their own. High implementers passed this stage of total teacher control, which enabled them to spend more time on instruction, and the children learned to use the computers independently.

High implementers reached a level of comfort with integrating computers into their instruction, which resulted in their children's extended use of technology. These teachers also stated that they made sure that the computers were available to each child to the same degree. They did not use computers as a reward or a disciplining tool. Most of the low implementing teachers did exclude disciplined children from using the computers or limited disciplined students' computer time. In these teachers' opinions, a child was not supposed to use a computer until he learned how to handle it properly. We believe, however, that children need to be given

sufficient time at the computer in order to learn how to use technology by following the teacher's modeling and explanations. By keeping away a disciplined child from the computer, a teacher removes that child's opportunity to learn how to use it.

Besides the instructional benefit of technology, teachers also considered technology as a motivational tool. The teachers noted that children were willing and eager to spend extended periods of time in front of the computers working on educational software activities.

The Role of the Community as an Authentic Learning Environment

High implementing teachers addressed the role of the community and their classroom role whereas lower implementing teachers did not. High implementers saw the role of the community as both motivational as well as instructional for the children. They expressed one of the critical dimensions of TRALE as its role: the community provides a context for instruction, which may result in children's higher motivation for learning; i.e., the community provides practice of the concepts the children learned in class. Providing context for instruction makes learning more meaningful for the children. As it was mentioned in the theoretical foundations of TRALE, one of the assumptions of the project is that knowledge acquired and practiced in authentic environments will be learned by the students faster and more efficiently, it will be retained longer, and it will be retrieved when this knowledge is activated.

Besides the instructional implications, the motivational potential of the community was also emphasized by the high implementing teachers. Being a member of a community motivates the teachers as well as the children to cooperate with one another. High implementers had an elaborate schema representation about their own classroom roles and the community. They understood what they and their children were supposed to do in order to participate in the community functions successfully. Low implementing teachers did not address the educational potential of the community. We assume that because they may not have understood how the

community was supposed to function, they did not feel comfortable and empowered to participate. High implementing teachers ensured their children's equal participation in their own classroom roles as well as the community regardless of the children's initial ability level and behavior problems.

High implementing teachers discussed the learning activities in their classrooms. They gave long descriptions of authentic activities in their teacher logs, whereas low implementing teachers usually left that section blank. The Newsroom teacher, for instance, described the process of her children's publishing the paper including interviewing, typing, editing and so forth. The children in the theater class wrote scripts, made costumes and masks for their performance, practiced the play, created invitation cards, and performed in front of the community audience.

The instructional strategies that the high implementing teachers applied the most were peer coaching, discovery learning, problem-solving, and modeling for the children. The data showed that the high implementing teachers organized the instruction very differently from low implementers by using more child-centered, developmentally appropriate, and instructionally sounder methodologies.

One of the hardest things for the teachers was to create the activities based on the content standards. Only high implementing teachers talked about "matching" and "relating" instruction and the standards. From the interview and document analysis it became obvious that in the low implementing classes, activities were designed on the basis of their appeal to the teacher with no reference to the standards whereas in the high implementing classes the standards guided instruction. To low implementers the standards seemed to be an extra burden that they had to deal with during planning time.

Conceptual Understanding of TRALE

High implementers seemed to understand the principles of TRALE right after training. This understanding became even clearer as the teachers put the program into practice. Informal observations of the degrees of program implementation confirmed that they were implementing all the components pertaining to each critical dimension of the program. Their existing schema of the project became refined as the result of constant feedback from the PIs, the facilitator, and their children.

Low implementers had a hard time understanding the educational potential of the TRALE project. It took them much time to grasp the basic principles of the project, and this partial understanding of TRALE was reflected in their low implementation of the project as well as the types of activities they designed for their children. Finally, when they understood what TRALE was about, the activities in those classroom roles became more meaningful and the teachers slowly began thinking about how the classroom activities would relate to the curriculum standards.

The teachers were asked about factors influencing the degree of implementation of the program. We assumed that lower implementation may have been due to teachers' poorer understanding of the program's educational potential. Our assumption was confirmed. However, teachers' poor conceptualization of the program was only one factor.

During the interviews several problems surfaced that had affected the degrees of implementation of TRALE. One of them was the whole-day implementation of the project. The high implementing teachers made all the effort to make it a year-around whole-day function whereas low implementers implemented the program only partially by incorporating it into their "traditional" methodology for only an hour or two a week.

Another factor affecting the implementation of TRALE was the issue of time and effort. Some teachers said that planning for and implementing TRALE took so much time that not all the teachers were willing to invest that amount of effort into the program. Not having enough planning periods added to the problem. The issue of support from the school system also surfaced, and these teachers really felt that their work was not at all appreciated by DCPS. These emerging themes dominated the conversation much more than we expected.

Another variable affecting the implementation of TRALE was the pressure, put on teachers by the Central Office of the DCPS, which made the circumstances at Target Elementary less than favorable for full implementation of the program. The teachers also stated that the testing block introduced by the school administration in the middle of the day adversely affected TRALE's implementation. The activities oftentimes had to be interrupted because all the classes were supposed to start practicing test taking skills at a certain time during instruction.

In sum, the CUA team assumed that low implementation of the program was due solely to teachers' poor conceptual understanding of the program. Besides teachers' conceptual understanding of TRALE, other important factors surfaced that influenced the degrees of implementation; for instance, few or no incentives, few planning periods, pressure from the school system, lack of support from administration, and the introduction of a testing period in the middle of the day.

Implementation by teachers

As it has been mentioned before, the TRALE DOI instrument was developed at the end of the 1997-98 school year, thus the project team decided to look at four indicators, which together provided a system to examine the degrees of implementation in each participating classroom. First, using the calendars of events and activities, cross-referenced against minutes of the weekly meetings and teacher journals, we obtained an index of the level to which teachers

accomplished what they had set out to achieve (how many of the planned activities occurred throughout the year). Second, we decided to get information about the teachers' level of involvement in TRALE by looking at their attendance at weekly meetings. We also looked at the number of journal entries submitted and the content of those entries as additional quantitative and qualitative indices of teacher interest and involvement. Finally, anecdotal descriptions of teachers' daily implementation of TRALE from the facilitator's journal entries supplemented the data. In the paragraphs below, we extract information about the implementation of TRALE by individual teachers using these 4 indicators. We refer to teachers by their classroom role.

Here we briefly describe all our 8 teachers' degree of implementation in the 1995-96, 1996-97, and 1997-98 school years.

African Heritage Museum. This kindergarten teacher planned to open the African Heritage Museum at the beginning of each school year, however, she always seemed to become overwhelmed right after the school year had started. In her first year (1996-97), this teacher generally seemed interested and enthusiastic about TRALE. She organized several exhibits with her children and was an active member of the community. In 1997-98, when the TRALE project was integrated with the ALEM model, this teacher focused on creating the ALEM components in her classroom. She needed an extensive period of time to conceptualize what ALEM was about and how the components would be developed in her classroom. Her exclusive focus on ALEM adversely affected her TRALE implementation. This teacher appeared to be interested in the project but also overwhelmed by the responsibilities and tasks posed by ALEM alone and an integrated implementation of ALEM and TRALE. In that school year, the museum did not even open for business. Her children had very few opportunities to participate in the community events. Our DOI criteria made her an overall low implementer .

The Sandmeier Theater. This high implementing kindergarten teacher conceptualized what TRALE was about and how the theater setting would be part of the TRALE community soon after the program had been introduced at Target. Her class produced several performances that were also recorded on video. The children prepared the props themselves, they were also responsible for the costume design and construction. The kindergartners used the play's script as a basis for practicing reading, writing, and speaking. Technology aided in the creation of some costumes, banners, programs, and invitation letters.

This class was also a regular contributor to other community interactions. Students shopped at the store as scheduled, rented videos from the video store, bought art work in the art gallery, had some of their letters mailed by the post office, and attended the poets' performance.

When ALEM was introduced in the school, she started implementing all the components immediately, which left her more time to concentrate on TRALE.

According to the evaluative system of meeting attendance, number and quality of journal entries, calendar of events, she was one of the high implementers in the project.

"D" Art Gallery. Soon after this kindergarten teacher had been trained in TRALE in the 1997-98 school year, ALEM was introduced at the school. Thus all her efforts were focused on creating and implementing all the ALEM components in her classroom. Reorganizing her class and modifying her instructional strategies consumed most of her time. Once the teacher started meeting with the facilitator on a regular basis, she became energized and motivated. As soon as she prepared her children and the environment for opening "D" Art Gallery with the help of the facilitator, the gallery was operated smoothly. Various jobs were offered in the art gallery for the children to participate in. The jobs in the gallery included the greeter, who greeted the arriving customers at the door; the cashiers, who were responsible for collecting the money as well as writing and stamping receipts; the guides, whose job was to accompany the customers giving

them information about the artists and the prices of the art to be sold; and the artists themselves, who provided their signatures on the receipt after the piece of art had been purchased. The children, however, were not given the opportunity to choose and apply for any jobs; the teacher assigned them to each job. The teacher was constantly reminded to provide equal opportunities for all the students by letting the lower achieving children practice for the harder jobs (e.g., cashier) by being "trained" (helped) by a more experienced peer. However, this practice was not changed during the implementation of her classroom role. The kindergartners in this classroom drew, painted, and cut out pictures; created playdough compositions and string imagination pictures; and wrote compositions. The children prepared all the materials that were later put on display for the other children to purchase.

The students in this class participated in the TRALE community by visiting other classes. They saw a performance in the theater, listened to poems written by the poets, went shopping to the store, rented videos, and had some letters delivered by the post office.

The teacher's participation in the program considering all the evaluative criteria made her a low TRALE implementer.

Kidstown Post Office. The post office was operated by a first grade class whose teacher was a new member of TRALE in the 1997-98 school year. After her training, she soon conceptualized what TRALE was about. As soon as she was trained in ALEM, she rearranged her classroom according to the ALEM critical dimensions and began focusing on TRALE. The children did get involved in writing letters much earlier than the actual implementation of the post office. Once the post office was officially open, it functioned twice a week on a regular basis. The children collected mail once a week and delivered it on another day.

All the children had an equal chance of participating within and across the classrooms. The postal workers visited the art gallery where they purchased works of art prepared by the kindergartners, they saw the performances presented by the theater, they rented videos in the video store, they went shopping to the general store, had a few stories published in the newspaper, and listened to the poems written by the third graders.

The teacher's overall participation in the project according to our criteria was high.

B & G Video Store. This first grade teacher whose class housed the video store participated in TRALE after its pilot implementation. During her first and second year in the program, she always seemed to be enthusiastic about the program but appeared to lack a deep understanding of the basic concepts and goals of TRALE. Because of her poor conceptualization of the fundamental principles and concepts of authentic learning environments, she received extensive assistance from the project team. Because the teacher felt overwhelmed by the various demands and expectations of the school administration, she kept postponing the opening of the video store. The children's activities reflected very little relation to the video store, and the children were familiarized with this particular classroom role very late in the school year. With assistance from the project team, she completed the foundation work for the video store, and it was opened for the community. The store hours were sporadic, and some of the visits by other classes were cancelled, however, the store at least was in existence. The teacher did not seem to view TRALE as an all-embracing context with an overall goal structure for instruction. Thus the video store was in operation only when it was open for a couple of hours during the week. During the school day when the store was not open to visitors, it did not provide context for activities that were supposed to be embedded in it. With the assistance of the team, the children applied for jobs, such as cashiers, inventory keepers, security guards, and sales people. Technology was used to make posters, inventory lists, video labels, forms, and banners. A wide selection of movies was

available for the children to rent. Having paid $1 for the rental, the children were allowed to take a video home and watch it for one evening. The inventory keepers had lists of all the movies in several categories to keep track of the movies.

The children in that class participated in the community to some degree by visiting other classes. They went shopping to the store, heard the poets' performance, visited the art gallery, and had some letters mailed by the post office.

Even with extensive support, this teacher implemented TRALE inconsistently and was considered to be a low implementer of the program.

All-Stars General Store. This teacher in the general store participated in TRALE from its pilot implementation to the 1997-98 school year. She had a very clear understanding of TRALE and had extensive experience in running the store. Because of her familiarity, she set realistic goals and knew how she had to organize the activities in her class to make the most of an authentic environment. She used the TRALE concept successfully to embed her instruction in the store and thus offer the most opportunities for her children to acquire all the skills and be motivated to learn. She was also trained to implement the ALEM model, and the beginning of the 1997-98 school year was spent on putting the pieces in their places. As soon as she completed reorganizing her class and creating all the ALEM components, she was ready to prepare the children for working in the store. The general store was open twice a week according to the schedule planned at the teachers' meetings and was functioning very well on a regular basis. All the children had equal opportunities for participation in the various activities. The students had to apply for the jobs using application forms. Once a person was hired, the teacher and peers prepared the individual for completing the job. The various jobs included cashiers, security guards, sales people, and inventory persons. All the children participated in setting up the store twice a week and preparing some of the merchandise to be purchased. Children ran the store with

very little assistance from the teacher. The children's other responsibilities included setting up the store, manufacturing some merchandise, inviting the other community members, and accompanying them to the store and back to their classes. In the store context, technology use included taking inventory and making products to sell.

Students from the store regularly interacted with students in the other classes. They visited all the above mentioned classrooms and actively participated and used the services provided. Since this teacher was one of the highest implementers of TRALE, she had the skills and strategies to find all the opportunities for her children to benefit from the activities offered by the other classes; i.e., her students always wrote thank you notes whenever they saw a performance or a presentation, they had articles published in the newspaper, and wrote about the art work they had purchased in the gallery. She activities that she created were always based on the content standards of DCPS.

Her level of participation in the program was outstanding. According to our evaluative criteria, she was one of the highest implementers of TRALE.

The Target News. This third grade teacher also participated in the pilot implementation of the TRALE program. Her prior participation was beneficial in helping her set goals for her classroom and in getting the newspaper started. She is the only teacher whose project participation across the years changed. During the pilot implementation of TRALE and in the following school year, she was an active and enthusiastic TRALE implementer. She successfully created an authentic learning environment that functioned on a regular basis. Jobs in the Newsroom included messengers, special helpers, collectors of things, filers of papers, homework checkers, committee members to hire applicants, money recorders on payroll cards, computer tutors, reading tutors, consultants for the general store, and story consultants. The newsroom children performed a variety of tasks in order to put out the paper. They roamed around the

building in search of stories, took notes and took the potential story topics back to the classroom, created story board- language experience charts, met in order to brainstorm about possible interview questions, decided upon what questions would be asked during the interview, role played about how to make contact with people and how to conduct an interview, conducted the interviews while taking notes at the same time, wrote the articles, edited them on the computers, used *Clip Art* software for purposes of decoration, and made the paper's layout. In the classroom, technology also included the use of scanners and digital photography. The Washington Post printed the paper. The paper was distributed and read all around the school by the community members, faculty, and staff.

The newsroom workers were active members of the TRALE community by visiting other classes and using the services they provided. The children participated in all the activities that were offered within the community. The newsroom people then gathered information and ideas for future articles in the other classes and then wrote about their community experiences.

This teacher's participation was considered to be high in the pilot study and the 1996-97 school year. Unfortunately, due to many extraneous variables, she lost her momentum in the 1997-98 school year when she became a low implementer.

Renaissance Writers' Club. This teacher whose class housed the Renaissance Writers' Club was in her first year of implementation in the 1997-98 school year. This teacher spent the first semester on getting familiarized with the components of ALEM and trying to set up her classroom according to the critical dimensions of the program. She seemed to have difficulty with conceptualizing the underlying principles of ALEM and thus needed an extended period of time to begin creating some of the components. It took her almost the whole year to redesign her classroom, thus she had little time to reflect on how she wanted to introduce the poetry club to her students. After some meetings with the facilitator, she became motivated and enthusiastic

and began preparing the students for the club. The first poems in the club were "name poems" that the students enjoyed writing. When the teacher noticed that the children got hooked on poems and were very successful in writing name poems, she introduced more complex activities that resulted in very elaborate poems. The regular sequence of events in the poetry club was the following: (1) the children brainstormed about possible rhymes for various words, (2) they came up with different lines, (3) they wrote their own poems, (4) having written the poems, the students listened to each other's work, (5) they typed their poems in the computer, and (6) went to each class to perform to the other community members. These performances were videotaped.

This teacher did not provide her students with opportunities to use other community members' services on a regular basis. This teacher's level of participation in the program and our evaluative criteria made her a low implementer.

Summary.

The results of this formative evaluation paper clearly demonstrate that TRALE's effectiveness was directly related to its degrees of implementation. Our analyses indicated a tremendous growth in students' academic progress in highly implementing teachers' classes compared to low implementing or non-project teachers' classes. Three years of data proved TRALE to be an effective integration of technology and the concept of a community in the early childhood grades in order to create authentic literacy environments for young, urban children to learn. Our results are encouraging, and we are looking forward to the successes in the upcoming years.

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